(12) UK Patent Application (19) GB (11) 2 130 399 A

(21) Application No 8327715
(22) Date of filing 17 Oct 1983
(30) Priority data
(31) 8229639
8233352
(32) 16 Oct 1982
23 Nov 1982
(33) United Kingdom (GB)
(43) Application published
31 May 1984
(51) INT CL³
G07F 13/06
G05B 15/02
(52) Domestic classification
G3N 260 381 382 383 390
402 404 BA2A
U1S 1892 G3N
(56) Documents cited
GB A 2091449
GB A 2067311
GB A 2063515
GB A 2034922
GB A 2119124
Specification WO
80/00202
(58) Field of search
G3N

(71) Applicant
Westomatic Vending
Services,
(United Kingdom),
Bradley Lane,
Newton Abbot,
Devon TQ12 1NA.
(72) Inventor
Richard John Sheridan
Brinsley
(74) Agent and/or Address for
Service
M. J. Stephens & Co.,
46 Tavistock Place,
Plymouth PL4 8AX.

(54) **Vending machine**

(57) A drinks vending machine is provided with a microprocessor-based control system for controlling the selective operation of the machine actuators (10) to dispense any one of a number of different drinks. The control system includes an electrically alterable memory (18) for storing data on the required operating times of the machine actuators (10) for each different drink to be dispensed, the memory (18) being arranged to retain the data stored therein upon disconnection of the machine from its electrical supply. An input device (19) enables an attendant to alter the stored operating times to take account of changes in such factors as cup size and ingredient strength. The electrically alterable memory (18) can also be used to store data on the number of doses of each ingredient that remain to be dispensed.

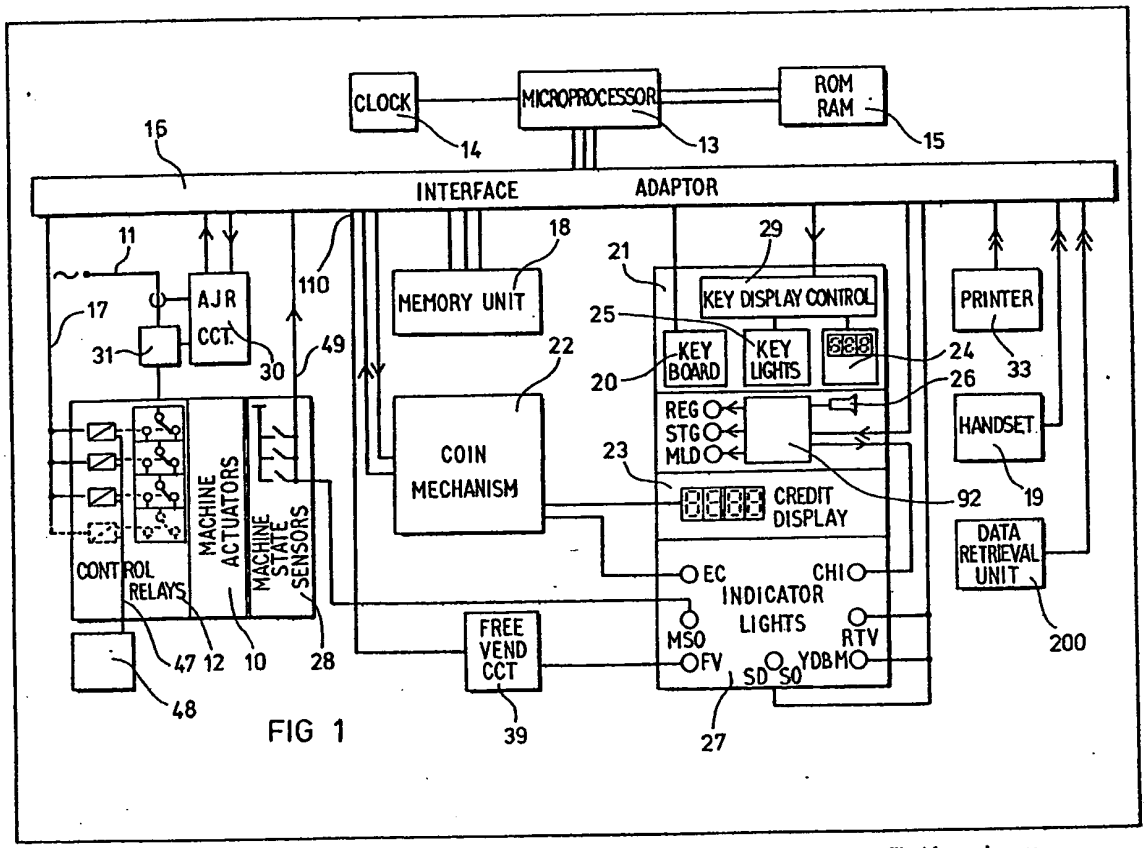

FIG 1

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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

2130399

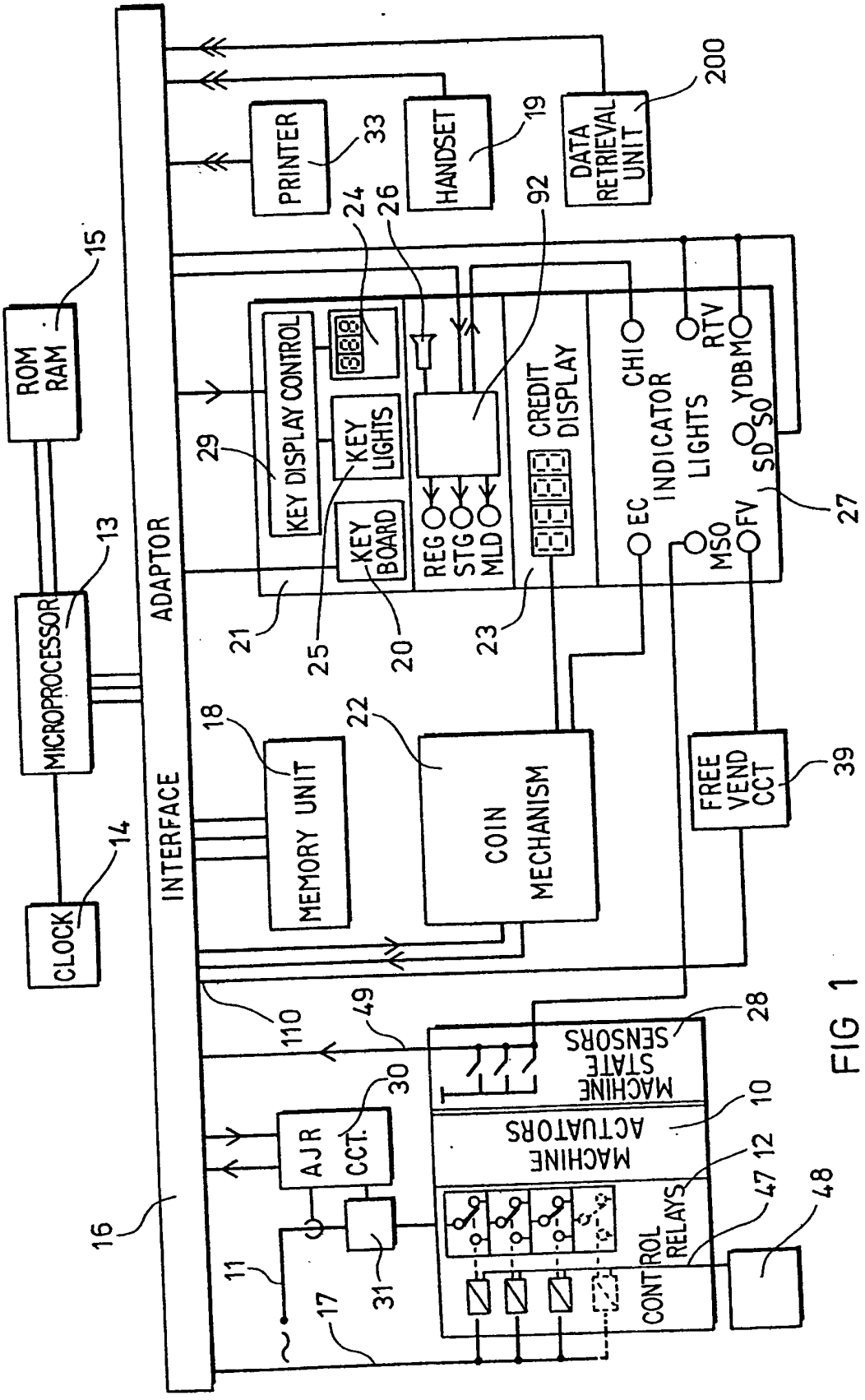

FIG 1

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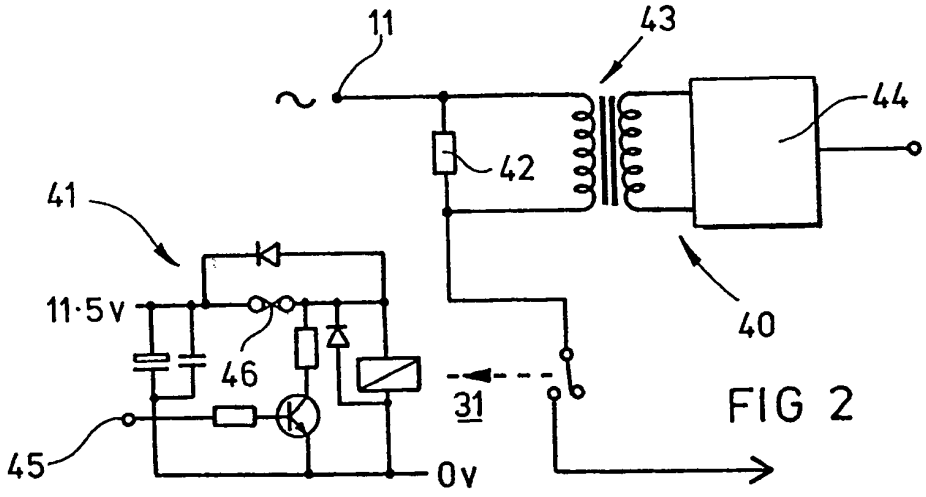

FIG 2

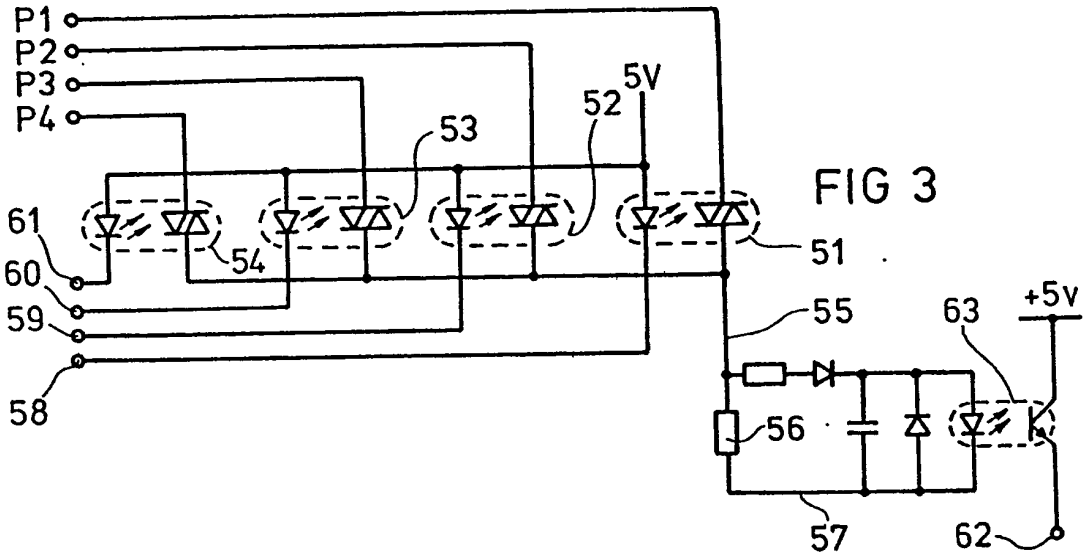

FIG 3

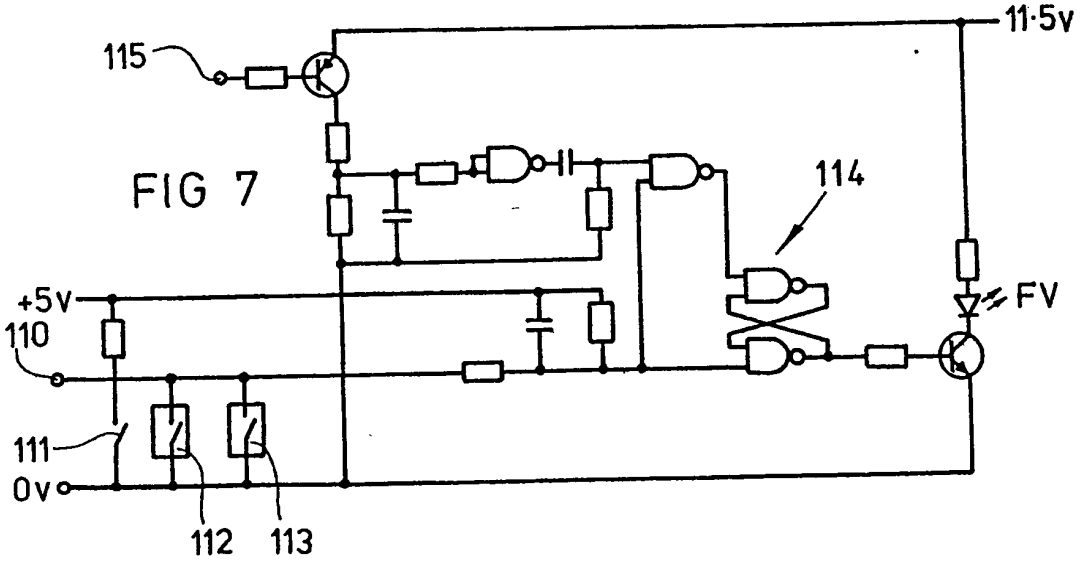

FIG 7

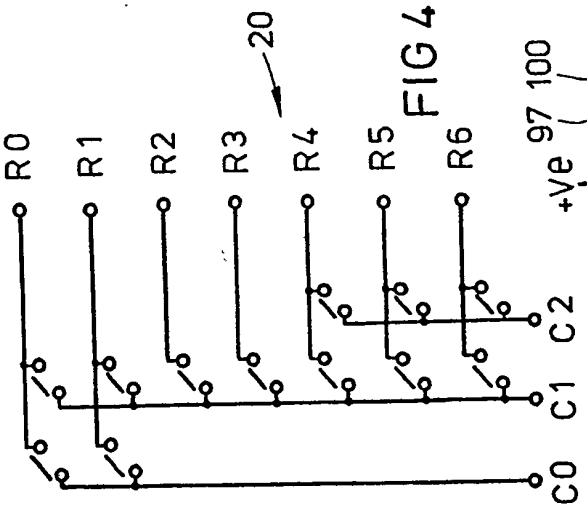

FIG 4

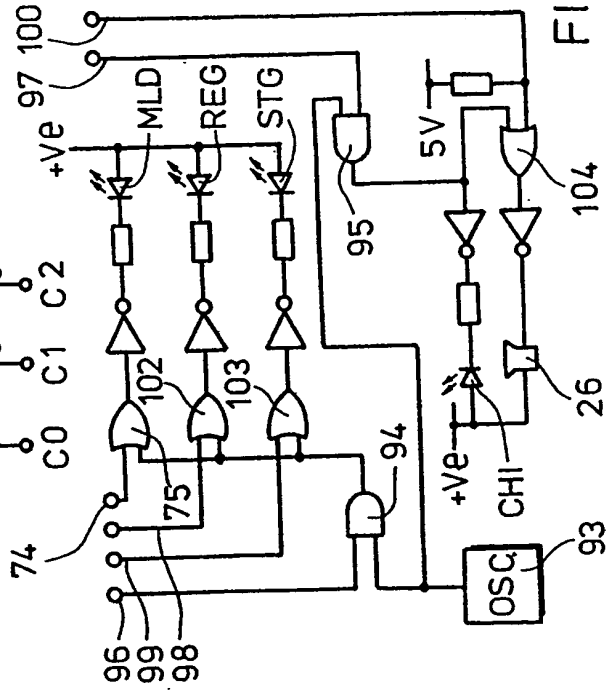

FIG 6

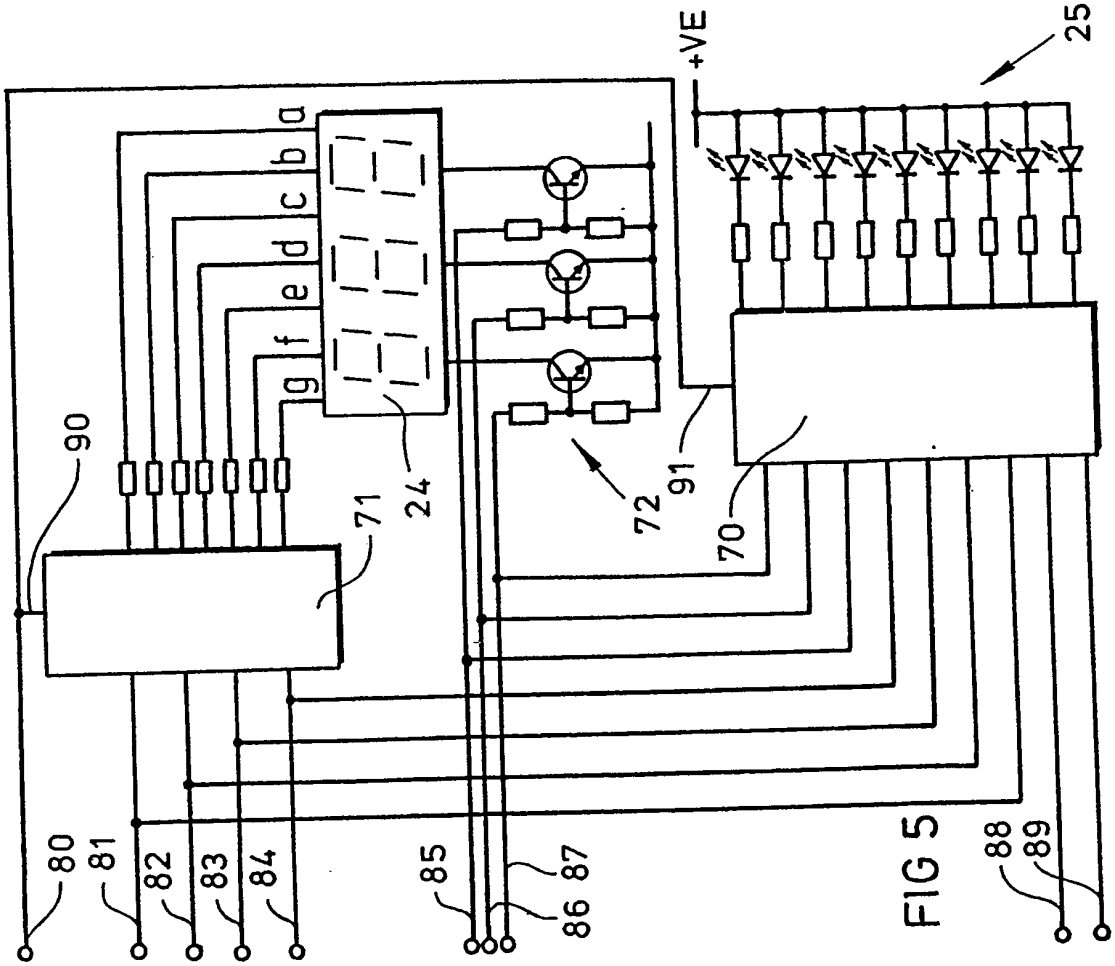

FIG 5

SPECIFICATION

Vending machine

The present invention relates to a vending machine and, in particular, but not exclusively, to a microprocessor-controlled drinks vending machine.

Known drinks vending machines generally incorporate control systems built around electro-mechanical control elements interfacing directly at mains voltage with the various machine actuators (pumps, motors, valves). A major drawback of such control elements is their lack of versatility which makes it very expensive to implement operational changes or to extend the control functions available. One particular area where this lack of versatility presents problems is in making timing adjustments to the time of operation of the machine actuators such as may be required to vary drink strength or to take account of different sized cups.

Accordingly, it is an object of the present invention to provide a drinks vending machine with a more versatile control system enabling easier adjustment of actuator operating times.

According to one aspect of the present invention, there is provided a drinks vending machine including a plurality of machine actuators selectively operable to prepare any one of a number of different drinks from different types of ingredients stocked in the machine, and an electronic control system for controlling said actuators in dependence on the identity of a drink selected through a customer input device of the control system, said control system including both an electrically alterable memory for storing data on the required operating times of the machine actuators for each of said different drinks, and an attendant input device for altering the value of the operating times stored in said memory, the memory being arranged to retain the data stored therein upon switch off of the main electrical supply to the machine. Preferably, the control system is built around a microprocessor and the said electrically alterable memory is either a non-volatile Electrically Alterable Read Only Memory (EAROM) or a battery-backed volatile Random Access Memory (RAM); in the latter case, the battery ensures that the memory remains energised upon switch-off of the mains electrical supply of the machine.

The use of a microprocessor-based control system enables a variety of desirable features to be realised such as customer interaction, audit data collection, and automatic fault diagnosis. Furthermore, since the operation of such a control system is defined by software generally stored in plug-in memory chips, it is possible to introduce operational modification simply by replacing one chip with another, a process which is both cheap and rapid.

Another drawback of known drinks vending machines is that if the ingredient stocks are not replenished sufficiently frequently, the situation can arise where a drink is dispensed lacking one or more ingredients. One possible solution to this problem would be to provide sensors to detect a "low-stock" state for each ingredient, the detection of such a state inhibiting operation of the vending machine. Such a solution is, however, unsatisfactory from the point of view that it requires the use of sensors which are not only expensive but prone to failure.

Accordingly, in the preferred embodiment of a drinks vending machine according to the present invention, the control system is so arranged that for each type of ingredient stocked, an attendant can set into the control system, via said attendant input device, data relating to the maximum number of doses to be allowed to be dispensed from the current stock thereof, the control system being further arranged to monitor the number of dispensed doses of each type of ingredient and to inhibit the preparation of a selected drink should that drink require the use of an ingredient of a type which has already been dispensed a number of times corresponding to the said maximum number associated with that ingredient type, data concerning the remaining allowable number of doses of each type of ingredient being held in said electrically alterable memory.

Provided a conservative estimate is set into the machine of the total number of dispensable doses of each ingredient type, the situation is avoided where a drink is dispensed with one or more ingredients lacking.

Whenever the machine is restocked by an attendant, he uses the attendant input device to update the control system in respect of how many doses of each particular type of ingredient can be dispensed before the dispensing of a drink incorporating an ingredient of that type is inhibited. Since generally, restocking will take place prior to the exhaustion of existing stocks, the control system is preferably so arranged that the attendant only has to set in the number of dispensable doses of a particular ingredient type in any newly added stock of that ingredient type, the control system calculating for itself the new value of the corresponding said maximum number of doses by adding the set-in number with the remaining number of doses to be dispensed from the stock of that ingredient type present in the machine prior to restocking.

Preferably, whenever the dispensing of a drink is inhibited this fact is indicated to the customer to enable him either to choose a different selection or, in the case where the customer has already inserted money into the machine, to obtain a refund.

The stock control facility can also be provided on vending machines other than drinks vending machines. Accordingly, in another aspect, the present invention provides a vending machine including dispensing means arranged to dispense any one of a number of selections each made up of one or more types of components stocked in the machine, and a control system for controlling the said dispensing means in dependence on the identity of a said selection chosen through a customer input device of the control system, said control system including a stock-data input device by means of which an attendant can set into the

control system, for each type of component stocked, data relating to the maximum number of times a component of that type is to be allowed to be dispensed from the current stock thereof, the control system being arranged to monitor the number of times each type of component is dispensed and to inhibit the preparation of a said selection should that selection require the use of a component of a type which has already been dispensed a number of times corresponding to the said maximum number associated with that component type.

Various other novel aspects and features of the invention will become apparent from the following description, given by way of example, of a microprocessor-controlled drink vending machine, reference being made to the accompanying diagrammatic drawings, in which;

Figure 1 is a block diagram of the vending machine;

Figure 2 is a circuit diagram of an anti-jackpot system of the vending machine;

Figure 3 is a circuit diagram of interface circuitry suitable for use with one form of coin mechanism;

Figure 4 is a diagram of a customer input keyboard of a selection/display panel of the vending machine;

Figure 5 is a circuit diagram of an input-code display and key lights circuit of the selection/display panel;

Figure 6 is a circuit diagram of circuitry used to control various indicator lights of the selection/display panel;

Figure 7 is a circuit diagram of a free vend circuit of the vending machine; and

Figure 8 is a diagram of a plug-in handset of the vending machine.

General Description

As shown in Figure 1, the drinks vending machine comprises a plurality of electrically-operated machine actuators 10 (such as pumps, valves and ingredient motors) selectively energised from an A.C. supply 11 (typically 240 v or 110 v) by means of control relays 12. The energisation of these relays 12 is in turn controlled by a microprocessor-based control system of the machine.

The heart of the control system is a microprocessor 13 with an associated quartz-regulated clock 14, and ROM/RAM memory 15 for storing the control program software. An interface adaptor 16 interfaces the microprocessor 13 with the control relays 12 via a bus 17. Data on the required operating or "throw" times of the machine actuators 10 is stored in a memory unit 18 constituted either by a non-volatile EAROM memory chip (that is, an electrically alterable read only memory) or by a battery-backed RAM memory chip. The memory unit 18 is accessed by the microprocessor 13 via the interface adaptor 16 and the throw times stored in the unit 18 are set to the nearest 0.1 sec.

The memory unit 18 as well as storing throw time data, also stores drinks price data, ingredient stock data, audit data, and a machine identity number, all these data requiring to be adjustable but retained upon switch off of the machine. As will be more fully described hereinafter, the data stored in the memory unit 18 can be externally adjusted using a plug-in handset 19.

Drink selection is effected through a keyboard 20 of a customer selection/display unit 21. The keyboard 20 is only enabled after money has been inserted into a coin mechanism 22 of the machine, the amount of money inserted being displayed on a four-digit credit display 23 of the unit 21.

In the present example, drink selection is effected by keying in a drink code (up to three digits) representative of the drink required (for example, tea, coffee, cold drink, soup, chocolate, etc.). The keyed in code can be displayed on a three-digit display 24 though the provision of this display is optional.

Customer reassurance features include the provision of key lights 25 controlled to light up a keyboard key as it is pressed, and a bleeper 26 which sounds upon depression of any keyboard key. The display 24 (where present) and key light 24 are controlled from the microprocessor 12 via a key display control unit 29.

In the case of certain drinks such as tea or coffee, once a drink code has been keyed in the control system asks the customer to make a further selection regarding drink strength (mild, regular or strong) by flashing lights MLD, REG and STG associated with corresponding keyboard keys; strength selection is made by pressing the appropriate keyboard key.

After the drink selection process has been completed, and assuming that the accumulated credit is sufficient for the drink selected, the control system energised selected ones of the machine actuators 10 for the periods required to dispense the selected drink. During this period, operation of the coin mechanism 22 is inhibited and the microprocessor, as well as timing the actuator operating times, also updates various audit data relating to money received and drinks dispensed.

The selection/display unit 21 is also provided with a number of indicator lights 27 which operate to indicate various machine states. Thus when the machine is in a standby state awaiting the insertion of money into the coin mechanism 22 by a customer, a "ready to vend" light RTV is energised; thereafter, while a drink is being dispensed the light RTV is de-energised and a "your drink is being made" light YDBM is energised. Other indicator lights include a light EC which is energised from the coin mechanism 22 when it has run out of change and requires the insertion of the "exact change" for the drink selected; a "free vend" light FV energised by a free vend circuit 39 in certain circumstances to indicate that drinks are being dispensed free; and a light CHI to indicate that the customer should check the machine operating instructions (as, for example, where an unacceptable drink code is keyed in or the accumulated credit is less than the price of the selected drink).

Two further indicator lights MSO, SDSO are provided to indicate various "sold out" and non-operational conditions of the machine. The indicator light SDSO is arranged to be energised whenever a drink is selected

which requires the use of an ingredient the current stock of which has been used up, the energisation of this light indicating to the customer that he has the choice of making another selection or reclaiming his m ney. As will be more fully described hereinafter, the stock state of each ingredient is determined not by actually measuring the ingredient level, but by monitoring the number of doses of that ingredient used, the control system having been programmed when stocked up with the maximum number of doses to be taken from the newly added stock.

The energisation of the indicator light MSO is controlled by various machine state sensors 28. Typically, these sensors are constituted by switches connected in parallel and each arranged to close upon sensing a particular critical machine condition such as lack of cups, waste bucket full, or failed water supply. Detection of such a condition, as well as being indicated by the light MSO, is also signalled via a line 49 to the microprocessor 13 which as a consequence inhibits operation of the coin mechanism 22.

The indicator lights 27 are preferably constituted by light emitting diodes (LEDs).

The machine control system is also provided with an "anti-jackpot" circuit 30 which upon sensing current flow to the actuators 10 during periods when none of the actuators 10 should be energised, is arranged to isolate the actuator supply 11 by blowing a fuse in the energisation circuit of a normally-open relay 31 connected into the supply 11.

As already mentioned, the machine includes a plug-in handset 19 for adjusting the throw times and ingredient stock data; this handset is also arranged to selectively display the set throw times, ingredient stock data and various audit data. A plug-in printer 33 is also provided to give a hard copy read out of certain data. In addition a plug-in data-retrieval unit 200 enables the high-speed extraction of data from the machine for intermediate storage prior to hard copy output/analysis at a remote location. When any one of the printer 33, handset 19, or data-store unit 200 is plugged in, the normal vend mode of operation of the machine is inhibited.

A more detailed description will now be given of various parts of the machine. The basic microprocessor system (microprocessor 13, clock 14, memory 15, interface adaptor 16) will not, however, be further described since its implementation will be apparent to persons skilled in the art; in the present embodiment the microprocessor can, for example, be a Rockwell 6502 microprocessor with a clock rate of 921.6 kHz while the interface adaptor can be constituted by Rockwell 6520 peripheral interface adaptors, an 6522 versatile interface adaptor, and a 6551 asynchronous communication interface adaptor.

Machine Actuators

In the present embodiment, seven main categories of drink are provided, namely: coffee, tea, soup, chocolate, two flavours of cold drink (termed syrup 1 and syrup 2), and water. Further choices exist within these categories, thus for both tea and coffee there is an option for milk and an option for sugar while each cold drink can be prepared with still or carbonated water. Other choices can be provided but for simplicity these will not be considered here.

The dispensing of solid ingredients (tea, coffee, sugar, powder milk) is effected by ingredient motors, the dispensing of the syrups by pumps, and the dispensing of water by valves. A cup drop motor is also provided. These motors, pumps and valves are all electrically powered and constitute the machine actuators 10 whose sequencing and operating times are controlled by the microprocessor control system of the machine. A list of actuators 10 is given below:

Cup drop Motor	Coffee water valve
Coffee motor	
"Sugar for Coffee" motor	
"Milk for Coffee" motor	Tea water valve
Tea Motor	
"Sugar for tea" motor	
"Milk for tea" motor	
Soup motor	Soup water valve
Chocolate motor	Chocolate water valve
Syrup 1 pump	Syrup 1 valve
Syrup 2 pump	Syrup 2 valve
Water pump	Main water valve
	Carbonated water valve

The regular and strong selections available on coffee and tea are effected by using different throw times for the corresponding actuators.

For reasons of economy, each actuator is not provided with a corresponding control relay, but instead, the contacts of the relays are interconnected in a manner providing several switching decision trees whereby the number of relays 12 is minimised. Of course, the result of this is that generally several relays 12 will need to be energised by the control system to activate any particular actuator 10 but this task can be performed by the microprocessor 12 without difficulty simply by using a look-up table stored in memory to identify which relays have to be energised to activate the actuators 10 required for a selected drink.

As noted above, the microprocessor 13 selectively energises the actuators 10 for periods corresponding to

the appropriate throw times held in the memory unit 18. This timing control effected by the microprocessor 13 is in fact interrupt driven, a counter circuit (which in the present example is constituted by an internal counter of the Variable Interface Adaptor used in the interface adaptor 16) being arranged to generate interrupts at a 1kHz rate with every tenth or hundredth interrupt resulting in the microprocessor checking the actuator throw times.

The anti-jackpot circuit used to detect untimely operation of a machine actuator 10 is shown in Figure 2 and comprises a current sensor 40 arranged to detect current flow to the actuators, and a fused energisation circuit 41 which normally operates to close the relay 31 connected in the circuit of the actuator supply 11. The current sensor 40 is formed by a low-valued resistor 42 connected in series with the contacts of the relay 31, a transformer 43 connected on its input side across the resistor 42, and a signal shaping circuit 44 providing an output to the microprocessor 13 (via the interface adaptor 16) whenever a current flows in the actuator supply circuit 11. The microprocessor 13 monitors the signal from the circuit 44 following the completion of the preparation of a drink; if current is found to be flowing at this time (when all the actuators 10 should be de-energised) the microprocessor 13 feeds a signal to the input 45 of the circuit 41 in order to blow the fuse 46 and bring about de-energisation of the relay 31 and thereby isolate the actuators 10 from the supply 11. The blowing of the fuse 46 ensures that an attendant must inspect the machine before restart.

Referring to Figure 1, the operating coils of the control relays 12 are each shown connected between a respective line of the bus 17 and a supply return 47. In order to prevent momentary and erroneous operation of the relays 12, and thus of the actuators 10, at the instant of switch on of the vending machine and before the microprocessor 13 has gained full control over the interface adaptor 16, a delay circuit 48 is connected into the supply return 47 to effectively isolate the return 47 for a short fixed delay upon machine switch on. This delay is simply sufficient to enable the microprocessor 13 to gain operational control over the remainder of the control system and thereby prevent erroneous operation of the relays 12. As an alternative to the end of the delay period being predetermined by component values of the circuit 48, the circuit 48 can be arranged to delay connection of the supply return 47 until a predetermined signal is received by the circuit 48 from the microprocessor 13, this signal only being generated once the microprocessor 13 has full control over the control system.

The machine-state sensor switches 28 will generally be a.c. energised at mains frequency (50 Hz) so that upon closure an a.c. signal is fed to the interface adaptor 16. In fact, this signal is fed to the interface adaptor via a signal shaping circuit (not shown) which squares the signal. Of course, if the microprocessor 13 were to continuously monitor the signal received by the interface adaptor, it would appear as if there was an intermittent shortage of cups or other condition causing sensor activation. To overcome this, the received signal is software rectified, that is, the microprocessor is controlled so that upon detecting a high on the machine-state sensor input of the interface adaptor, it will wait a full cycle period (e.g. 20 ms) before sampling the signal again and so on. In this manner, a squared a.c. signal will appear as a steady signal to the microprocessor.

Coin Mechanism

The illustrated microprocessor-based control system can be arranged to interface with most coin mechanisms currently available. Generally the coin mechanism used must be capable of providing at least the following:

1) an indication to the microprocessor that some money has been inserted (this indication is used by the microprocessor 13 to render operative the keyboard section of the selection/display panel 21);

2) detailed information on the amount of credit accrued so as to enable a decision to be made as to whether sufficient money has been inserted for the drink selected;

3) an inhibit facility preventing the insertion of money at certain times (such as when a drink is being prepared, or when the machine is inoperative).

Furthermore, the coin mechanism 22 will also normally provide a visual display 23 of credit accrued, a suitable form of display being a four-digit, seven segment, LED display.

The most modern type of coin mechanisms such as the "Executive" mechanism made by Mars Limited of England provide for interfacing by means of a serial communications link thereby enabling considerable data transfer between the coin mechanism and microprocessor 13 via an Asynchronous Communication Interface Adaptor forming part of the adaptor 16. With such a coin mechanism, the microprocessor has access to all audit data held by the mechanism and can readily assess when a coin has been inserted and what drinks may be dispensed for the value of credit accrued (this latter assessment being possible since the price of each drink choice is held in the EAROM memory 18 and is accessible for comparison with the credit accrued figure).

The older types of coin mechanism generally provide four price line outputs each corresponding to a particular drink price (only four prices being allowed) and which are successively energised at a.c. mains voltage as the value of credit accrued by the insertion of coins reaches the price level of each line in turn. Thus, the lowest price line will be energised first, followed by the second and so on, with energised lines remaining energised when a higher price line is energised.

With these older types of mechanism, an indication to the microprocessor that some money has been inserted can be obtained by suitably tapping the lowest price line except in the case of mechanisms such as the Mars "Mentor" Changegiving mechanism whose operation relies on current sensing on the price lines;

in this latter case the electrical circuitry of the mechanism can be monitored elsewhere to provide the desired indication.

Interface with the price lines to determine which drinks can be dispensed for the amount of credit accrued can be achieved using the circuitry shown in Figure 3. In this Figure, the four price lines are referenced P1 to P4, P1 being the lowest price line. Each price line P1 to P4 is connected via a respective opto-triac 51 to 54 to a common line 55 which, in turn, is connected via a resistor 56 to the a.c. mains return 57. The opto-triacs 51 to 54 have respective control input lines 58 to 61 which are connected to the microprocessor 13 via the interface adaptor 16. Upon a customer selecting a drink using the keyboard 20 (after the latter has been enabled by the insertion of money into the coin mechanism), the microprocessor 13 looks up the price of the selected drink in the memory 18 and then interrogates the corresponding price line P1 to P4 to check if enough credit has been accrued for the drink selected. This interrogation is effected by energising the appropriate one of the control input lines 58 to 61. If the price line corresponding to the selected drink has been energised, current will flow through the resistor 56 and result in an output signal being generated at the output 62 of an opto-isolator 63 connected across this resistor. This output signal is fed back to the microprocessor 13 to indicate that sufficient credit is present for the drink selected; the microprocessor then initiates the dispensing of the drink. If there is insufficient credit for the drink selected, no signal is fed back from the output 62 and the microprocessor will therefore not initiate dispensing of the drink but instead will energise the CHI ("Check Instructions") indicator light.

Selection/Display Panel

The microprocessor 13 is programmed to operate with an 8 by 8 keyboard matrix, this matrix being composed of eight sequentially energised columns and eight rows which are scanned through once during the energisation of each column. Each column-row intersection corresponds to a possible key position of the keyboard, the operation of a corresponding key serving to interconnect the associated column and row. Keyboards of this form are well known.

In the present example, eight column lines C0 to C7 and eight row lines R0 to R7 are available at the interface adaptor 16; however, the available keyboard matrix is in fact split between two keyboards, namely the keyboard 20 of the selection/display panel 21 and a keyboard of the handset 19. The keyboard 20 is allocated the matrix space corresponding to lines C0 to C2 and row lines R0 to R6 (see Figure 4) while the handset keyboard is allocated the matrix space corresponding to column lines C3 to C7 and row lines R1 to R7 (this latter keyboard will be more fully described hereinafter with reference to Figure 8).

As can be seen in Figure 4, the keyboard 20 has only nine keys in the fourteen available key positions given by the column lines C0, C1 and row lines R0 to R6. These nine keys are labelled as digit keys "1" to "9" and their operation enable a drink code to be keyed into the microprocessor 13. The third column C2 has only three keys (associated with row lines R4, R5, R6); these keys are for selecting "regular", "mild" or "strong" tea or coffee drinks.

As already mentioned, as each digit key is pressed to key in a drink code, a key light 25 associated with that key is illuminated; each key light 25 is in fact physically disposed beneath a translucent key top of the associated key. Furthermore, the keyed-in digit is displayed on the three-digit display 24 where provided. Shown in Figure 5, is a form of key display control unit 29 suitable for governing energisation both of the lights 25 and a display 24; this unit 29 comprises a driver circuit 70 for selectively energising nine LEDs constituting the key lights 25, and a decoder/driver 71 and three digit drivers 72 for energising a three-digit, seven-segment LED display constituting the display 24.

The energisation of the display 24 is controlled by the microprocessor 13 via seven lines 81 to 87 coming from the interface adaptor 16, three of these lines 85 to 87 going to the digit drives 72 to selectively enable each digit in turn, and the other four lines 81 to 84 going to the decoder/driver 71 to control selective energisation of the segments "a" to "g" of the enabled digit. A further line 80 connected to a blanking input 90 of the decoder/driver 71 from the interface adaptor 16, permits the microprocessor 13 to selectively blank out the display 24.

The seven lines 81 to 87, together with two further lines 88, 89 coming from the interface adaptor 16, are also connected to the driver circuit 70 to control energisation of respective ones of the LEDs 25. The line 80 is also connected to an inhibit input 91 of the circuit 70; however, the arrangement of the circuit 70 is such that when the decoder/driver 71 is inhibited the driver circuit 70 is enabled and *vice versa*.

The microprocessor 13 is programmed to update the key LEDs 25 and display 24 in the following sequence:

First display digit
Key LEDs
Second display digit
Key LEDs
Third display digit
Key LEDs
First display digit
Etc.

This updating is interrupt driven, each interrupt resulting in display update (as already discussed interrupts are generated at a 1kHz rate).

Of course, where the display 24 is omitted, the display control unit 29 is simply constituted by the driver circuit 70.

Figure 6 shows the circuitry 92 used to control the bleeper 26 and the lights MLD, REG, STG, and CHI. This circuitry includes a low frequency oscillator 93 (for example, 2Hz) the output of which is fed to two two-input AND gates 94 and 95; the other input of each gate 94 and 95 is connected to a respective control line 96, 97 controlled by the microprocessor 13 via the interface adaptor 16.

The output of the gate 94 is fed to three two-input OR gates 102, 103 and 75 the outputs of which control energisation of the lights REG, STG and MLD respectively. The output of the gate 95 is connected to drive the light CHI and to a two-input OR gate 104. Four further control lines 74, 98, 99 and 100 controlled by the microprocessor 13 via the interface adaptor 16, are respectively connected to the gates 75, 102, 103 and 104.

Upon sensing the depression of any one of the keys of the keyboard 20, the microprocessor 13 causes activation of the bleeper 26, via the line 100, to reassure the customer that he has successfully pressed the key.

If a tea or coffee code is keyed in via the keyboard 20, the microprocessor 13 will ask the customer whether he requires a mild, strong or regular drink; this is achieved by energising the line 96 to cause flashing of the lights MLD, REG and STG thereby inviting the customer to press the desired one of the three keys in keyboard column line C2 (the lights MLD, REG and STG are physically associated with respective ones of these keys). If no key is pressed within five seconds, the line 96 will be de-energised and the microprocessor 13 will assume that a "regular" drink is required. If one of the keys is depressed within five seconds, then the corresponding light will be continuously energised via the appropriate line 98, 99, 74 (the line 96 being, of course, de-energised).

In cases where a wrong drink code is keyed in or where insufficient money is inserted for the drink selected, the microprocessor will energise the line 97 to flash the light CHI and intermittently sound the bleeper 26.

It will of course be appreciated that the functions implemented in hardware by the circuitry 92 of Figure 6 could equally well be implemented in software with the microprocessor 13 separately controlling the lights MLD, REG, STG, CHI and the bleeper 26.

Free Vend

In certain circumstances, it may be desired to free vend all the drinks. Such circumstances are indicated to the microprocessor 13 by bringing low a normally high input 110 (Figure 7) of the interface adaptor 16. When the microprocessor 13 identifies a low on the input 110, it enables the keyboard 20 without the normal prerequisite of money being inserted in the coin mechanism; furthermore, the operation of checking the stored price of a selected drink against the credit accrued is also bypassed and the audit data updating is suitably modified to note the free vends made.

Bringing the input 110 low can be effected by any one of three devices, namely a biased-open toggle switch 111, a time clock 112, and a card reader 113. The switch 111 is only accessible to a machine attendant and enables him to run through a drink dispensing operation without having to insert coins. Since the operation of the switch 111 is only momentary (the biasing being provided to ensure that the switch is not accidentally left closed), the microprocessor software is arranged to memorise a low on the input 110 until after the end of the next dispensing operation when the input 110 is examined again.

The time clock 112 enables drinks to be dispensed free during certain times only, while the card reader 113 enables the dispensing of free drinks to card holders only.

The free vend light FV is controlled by the high or low state of the input 110. In view of the software-implemented memorisation of the state of the input 110 will after the next dispensing operation, a similar memory effect must be built into the circuitry energising the light FV as otherwise the situation will arise in which the light FV is extinguished but a free vend operation is available (such a situation would occur, for example, immediately following opening of the time clock contacts). Thus, as shown in Figure 7, energisation of the light FV is effected via a latch 114 which is set in a state to energise the light FV when the input 110 goes low. This latch 114 is arranged to be reset to de-energise the light FV not upon the input 110 going high, but upon the first energisation of the light YDBM by the microprocessor 13 after the input 114 has gone low. The signal energising the light YDBM is fed to an input 115 of the free vend circuit from the interface adaptor 16.

Test Vend

For various test purposes, such as checking the coin mechanism 22, the machine attendant may wish to insert coins in the mechanism 22 and then reclaim them, without the microprocessor recording these coins in the audit data. To this end, an internal switch can be provided (not shown) which can conveniently fill an unoccupied node in the keyboard matrix; closure of the switch will then be sensed by the microprocessor 13 as it scans the 8 by 8 switch matrix and this enables the microprocessor to suitably adjust its audit update routines during the next vending operation.

Printer

The printer 33 is, for example, a 20 column thermal dot matrix printer the presence of which is sensed by the microprocessor 13 at power-up to plac the machine in a print mod . This sensing may be achieved by

arranging for the printer when plugged in to short out two contacts which, for example, fill an un-occupied node of the 8 by 8 switch matrix of the control system; upon power-up, the microprocessor 13 is programmed to first check this matrix node for the presence of the printer.

The printer 33 interfaces with the microprocessor 13 via a standard RS232C serial link and the microprocessor when in its print mode is arranged to "dump" autmatically its audit data, drink price data, and a machine-unique identity number.

Data-Retrieval Unit

The print out of data via the printer 33 will generally take up a significant amount of time which can be of considerable inconvenience where data from a number of machines is to be collected. In order to speed up data collection, the plug-in data-retrieval unit is provided which enables the microprocessor 13 to dump at high speed all data to be output, this data being temporarily stored in the data-retrieval unit prior to transfer at a remote location to a data processing machine or output via a high-speed printer.

As with the printer 33, the data-retrieval unit 200, when plugged in, is arranged to short out two contacts filling an unoccupied node in the overall 8 by 8 switch matrix of the control system whereby to enable the microprocessor to detect the presence of the data-retrieval unit at powerup. Upon detecting the data-retrieval unit, the microprocessor goes into a high-speed data transfer mode. In one implementation the data-retrieval unit is configured as an EAROM memory powered up from the machine supply upon plug in and arranged to interface in parallel with the data bus lines and with the address and control buses of the microprocessor unit 13 in much the same manner as the permanently-connected memory unit 18. The microprocessor unit 13 in dumping data into the memory of the data-retrieval unit ensures that successive data words are entered into successive memory locations and at the end of data transfer the microprocessor energises an indicator light provided either as part of the machine control system or as part of the data-retrieval unit.

Preferably, the size of the memory of the data-retrieval unit is such that data from a number of machines (for example, fifty) can be simultaneously held in store. In this case, after each data transfer the controlling microprocessor unit enters the address of the memory location next to be filled in a predetermined location of the data-retrieval unit's memory. When the data-retrieval unit is next used, the microprocessor unit concerned will first look up where it is to store data before starting the data transfer; in the situation where the memory is in fact full, this will be apparent to the microprocessor unit from the stored identity of the location next to be filled and in this case the microprocessor unit can be arranged to abort data transfer and activate a warning light to draw the attendant's attention to the memory full condition of the data-retrieval unit.

After the memory of the date-retrieval unit has been unloaded (either into a data processing device or a line printer), the identity of the memory location next to be filled is reset to the start location of the memory.

Of course, the data-retrieval unit can take various other forms. Thus, for example, the interconnection of the address and control buses of the microprocessor unit with those of the data-retrieval unit's memory can be dispensed with if the data-retrieval unit is provided with suitable address control circuitry synchronised to the clock 14.

Another possible form for the data-retrieval unit would be a magnetic card insertable into a magnetic-card writing device of the control system; in this case, the microprocessor unit would be arranged to detect the insertion of the card into the writing device rather than the plugging in of a unit. On completion of data transfer, the microprocessor could cause the automatic ejection of the card.

Handset

As shown in Figure 8, the plug-in handset 19 comprises a 7 by 5 matrix keyboard 119 (arranged to plug in to column lines C3 to C7, and row lines R1 to R7), and a six-digit, seven-segment, LED display 120. The display is driven by a segment decoder/driver 121 connected to the display segment lines "a" to "f", and a digit decoder/driver 122 connected to the display digits. The decoder/drivers 121 and 122 respectively have four and three main input lines 123 which when the handset is plugged in are controlled by the microprocessor 13 via the interface adaptor 16. In addition, the decoder/driver 121 has a blanking input line 124 and the display has a decimal point line 125, both these lines also being controlled by the microprocessor 13.

The control of the display 120 and the scanning of the keyboard 119 are effected in standard manner. As with the printer 33 and data-retrieval unit 200, the handset, when plugged in, is arranged to short out two contacts filling an unoccupied node in the overall 8 by 8 switch matrix of the control system whereby to enable the microprocessor to detect the presence of the handset at power up. Upon detecting the handset, the microprocessor goes into an audit/adjust mode in which audit data can be displayed on the display 120, and actuator throw times, ingredient stock data, drink prices, and machine identity number can all be displayed and adjusted by operation of the keyboard 119. A more detailed description of the functions performed by the handset will be given hereinafter.

Ingredient Stock Control

As already mentioned, the indicator light SDSO is arranged to light up whenever a drink is selected requiring the use of an ingredient which has already been dispensed a predetermined maximum number of

times since the last restocking of the machine with the ingredient concerned; at the same time, the dispensing of the selected drink is inhibited and the customer is given the choice of reselection or reclaiming his money. Th value of this said predetermined maximum number is derived in the manner described below with a view to ensuring that the situation is never reached where a drink is prepared with one r more ingredients absent; the value of the predetermined number thus corresponds to a conservative estimate of the number of ingredient doses obtainable from the stock of that ingredient present after each restocking.

In practice, whenever an ingredient is restocked, the attendant sets in via the handset 19, data on the total number of doses to be taken from the newly added ingredient stock, this number being a conservative estimate of the number of doses attainable. The microprocessor 13 combines this set-in number with the number of doses remaining to be dispensed from the ingredient stock present before restocking, to derive said predetermined maximum number, that is, a number representing the number of doses which can be dispensed before restocking is required. This doses-dispensable number is stored in the memory unit 18.

When a drink is dispensed the microprocessor monitors how many doses of which ingredients are used and, for each ingredient, either keeps a running total (in memory 18) of the number of doses dispensed, or decrements by the appropriate amount the value of the corresponding doses-dispensable number stored in the memory 18; when, in the former case, the running total equals the initial stored value of said doses-dispensable number (that is, the aforesaid predetermined number), or, in the latter case, the value of the doses-dispensable number reaches zero, the next selection of a drink requiring the ingredient will result in energisation of the light SDSO and inhibition of the drink preparation operation.

To simplify the input of data by an attendant restocking the machine, the microprocessor control system can be arranged to store in the memory 18 ingredient stock constants representing, for example, the number of doses to be attributed to a bag of ingredient powder. In this case, whenever an attendant restocks the machine with, for example, coffee powder, all he is required to do is to input via the handset 19 the number of bags of coffee powder added (this number constituting a bulk-stock data input). The microprocessor will then combine this bulk-stock data with the appropriate stock constant and doses remaining to be used to produce a new value for the said predetermined maximum number, that is, a new initial value for the doses-dispensable number.

By way of example, if a coffee powder bag were to contain 227 grams of powder and one dose equals 1 gram, then instead of setting the coffee stock constant to 227, a conservative figure of 200 is preferably used to give a 10% margin of error whereby to ensure that no coffee selection is dispensed without the coffee ingredient.

Operation

The microprocessor-based control system controls the operation of the vending machine in accordance with the operating programe stored in the memory 15.

Upon power up of the machine, the microprocessor 13 first checks to see if the printer 33 is plugged in. If the printer is present, the microprocessor 13 automatically passes audit and identity data to the printer from the memory unit 18. Thereafter, the microprocessor switches off the machine to await re-power up.

If upon power up the printer 33 is not plugged in, then the microprocessor 13 next checks to see whether the data-retrieval unit 200 is plugged in. If this is the case, the control system switches to the high-speed data transfer mode and proceeds to automatically pass audit and identity data to the unit 200 from the memory unit 18. At the end of the transfer operation, the indicator light provided on the unit lights up and the unit can be removed allowing the control system to proceed.

If upon power up neither the printer 33 nor data-retrieval unit 200 is plugged in or if the unit 200 has been removed following data transfer, the microprocessor 13 next checks to see whether the handset 19 is plugged in. If this is the case, the control system switches to the audit-adjust mode which will be described more fully hereinafter.

If none of the plug-in units 19, 33, 200 are present on power up, or if the handset or data-retrieval unit have been removed following power up, the control system will pass into its vend mode of operation in which it will remain until powered down. In this respect it should be noted that if the printer, data-retrieval unit, or handset is plugged in once the control system is in its vend mode this will have no effect on the operation of the control system; since, however, the interface adaptor ports interfacing with the handset 19 also serve to provide interface with other peripheral devices during the vend mode of operation of the control system, during this latter mode the input line 124 is kept at a level such as to ensure that the handset display 120 is blanked out should the handset be plugged in. In this manner, the risk of the display being accidentally blown is avoided.

In the vend mode of operation of the control system, while the machine is in a "stand-by" condition awaiting a customer, the light RTV is energised to show that the machine is "ready to vend". In this condition, the customer keyboard 20 is effectively inhibited (that is, depression of its keys has no effect) pending insertion of money into the coin mechanism 22; th exception to this is where the free vend circuit has been operated to light the free vend light FV and indicate to the microprocessor 13 that drinks are to be dispensed free, or where the price of a particular drink has been set at zero (in this case, the operation of the keyboard will only have effect if the keyed in code corresponds to the zero priced drink).

Once the keyboard 20 has been enabled (by insertion of money into the mechanism 22, by operation of the free vend circuit, or by the presence of a zero priced drink) the keying in of a drink code will result in the

display of this code on the display 24 (where present) with the depression of each key causing the corresp nding key light 25 to be energised and the bleeper 26 to sound.

When the drink code has been keyed in, the microprocessor first checks to see if the drink selected involves the use of an ingredient which has already been dispensed the predetermined maximum number of times since last restocking. If this is the case, the light SDSO is energised giving the customer the option of reselection or reclaiming his money; otherwise the microprocessor proceeds to the next vend mode step.

Unless the free vend circuit 39 has been operated or the selected drink is zero priced, the microprocessor 13 next checks that the credit accrued in the coin mechanism 22 is at least equal to the price of the selected drink (this price being stored in the memory unit 18). If sufficient credit has been accrued or if the drink is free, the microprocessor 13 then proceeds to control the dispensing of the selected drink by operation of the appropriate ones of the machine actuators for "throw" times stored in the unit 18; during the preparation of the selected drink, the coin mechanism 22 is disabled by the microprocessor 13 to prevent the insertion of further money and the light RTV is extinguished and the light YDBM is energised.

If an erroneous drink code is keyed in or if insufficient credit has been accrued for the drink selected, then the light CHI will be flashed and the bleeper 26 intermittently sounded. In this case, and in the case where only a part code has been set in, the key display 24 (where present) and key lights 25 will be reset ready to receive a new code after a predetermined time period (for example, 5 seconds).

In the case of a tea or coffee code being set in, then before the microprocessor 13 checks the ingredient stock levels and the credit accrued against the drink price, it will ask the customer whether he wishes a "strong", "mild" or "normal" drink by causing the light STG, MLD, and REG to flash.

The customer makes his selection by pressing the appropriate key of the keyboard 20. In the absence of a selection being made, the microprocessor 13 will assume after 5 seconds that a normal strength drink is required.

During the actual preparation of a drink, the microprocessor 13 updates the audit data and ingredient stock data held in the memory unit 18 and is also interrupt driven to refresh the display 24 (where present) and key lights 25 and check the times of operations of the actuators 10 against the "throw" times stored in the unit 18.

After a drink has been dispensed, the microprocessor 13 checks via the anti-jackpot circuit 30 that current flow from the supply 11 to the actuators 10 has ceased. If this is not the case, the microprocessor 13 causes the fuse 46 to blow and at the same time inhibits the coin mechanism 22 and illuminates the sold out light MSO; the key display 24 (where present) and key lights 25 are kept energised to assist the machine attendant in diagnosing the fault which led to the microprocessor 13 blowing the fuse 46.

In the absence of a fault, at the end of dispensing a drink the microprocessor 13 de-energises the display 24 and key lights 25 and returns the machine into its stand-by condition in which the light RTV is energised and the light YDBM is de-energised.

As already described, the machine-state sensors 28 serve to provide an indication of when the machine has run out of cups, when the water supply has failed, or when the waste bucket is full, any one of these conditions causing the microprocessor 13 to inhibit the coin mechanism 22 and extinguish the light RTV; the light MSO is energised directly from the sensors 28.

Audit/Adjust Mode

In this mode of operation, the microprocessor 13 enables the handset 19 to effect a number of display and adjust functions, the main ones of which are described below;

a) DISPLAY THROW - by pressing appropriate keys on the keyboard 119, the microprocessor 13 can be arranged to put up on the handset display 120 the stored throw time associated with any particular drink component. Thus for example, to display the throw time of the coffee motor in the case where a strong coffee has been selected, the keys "strong", "coffee" and "display throw" would be depressed in that order, the throw time then being displayed as a two digit number between 1 and 99 which represents the throw time in units of 0.1 sec. To display the still water throw for the cold drink syrup 2, the keys "still water", "syrup 2" and "display throw" would be depressed and so on.

b) ALTER THROW - to alter any particular throw time the stored throw time is first displayed in the manner described above and then the required new time is entered using the digit keys of the keyboard 119. This new time is shown on the display 120 in place of the old time and the new time is entered into the memory 18 by pressing the key "memory store".

c) DISPLAY STOCK CONSTANT - the stored value of the stock constant of any ingredient (this is, the number of ingredient doses to be attributed to a standard input bulk, for example, a bag) can be brought up on the display 120 by pressing the appropriate ingredient identifying key followed by the key "display stock constant". Thus, for example, to display the stock constant for coffee, simply requires the pressing of the keys "coffee" and "display stock constant".

d) ALTER STOCK CONSTANT - to alter the stock constant of any ingredient the existing stored constant is first displayed and then the new constant is entered using the digit keys followed by the "memory store" key.

e) INPUT BULK STOCK DATA - to input the number of bulk stock units added of any particular ingredi nt during restocking of the machine, the appropriate ingredient identifying key is pressed followed by the "bulk stock" key; thereafter the number of bulk stock units added is set in using the digit keys followed by the

"memory st r " key.

f) DISPLAY PRICE - the stored price of any particular drink can be brought up on the display 120 by pressing th drink identifying keys followed by the key "display price". Thus, for xampl , to display the price f normal strength coffee simply requires the keys "coffee" and "display price" t be pressed.

g) ALTER PRICE - to alter the price of any drink the existing st red price is first displayed and then the new price is entered using the digit keys followed by the "memory store" key.

h) AUDIT FUNCTIONS - to display the number of paid for drinks of a particular type which have been dispensed, simply requires the drink-type key to be depressed followed by the key "total"; thus to display the total number of strong tea drinks dispensed, the following keys would be depressed, namely "strong", "tea" and "total". The total number of drink vends can be displayed by depressing the "total" key only, while the number of test vends can be displayed by successively depressing the "test vend" and "total" keys in that order. The total sales value can be displayed by pressing the corresponding key whereas the value of the test vends can be displayed by pressing the keys "test vend" and "total sales value". The stored audit data (number, value) relating to any particular drink type or to the total vends or test vends can be cleared by making a physical link (which, for example, occupies a matrix node of the 8 by 8 keyboard switch matrix), selecting the required audit function in the manner indicated above, and pressing the "clear" key twice.

i) IDENTITY CODE - as already mentioned, each machine is allotted a particular identity code and this can be brought up on the display 120 by pressing the key labelled "site number". To alter this code it is first brought up on the display 120 and then the new code is keyed in using the digit keys following which the key "memory store" is depressed.

The actual details of the software required to operate the microprocessor-based control system in the manner described above will not be described in detail herein since suitable software could be written by persons skilled in the art on the basis of the foregoing information.

Variants

It will, of course, be appreciated that although the microprocessor-based control system has been described with respect to a drinks vending machine, it could also be used to control other forms of vending machine. Furthermore, the term "vending" is clearly to be interpreted broadly in view of the fact that the described vending machine can operate in a free vend mode in which, in fact, no vending as such takes place but merely the dispensing of drinks free of charge.

It will also be appreciated that the control system could be implemented by electronic means other than a microprocessor though the versatility and availability of the latter renders it highly suitable for implementing the required control and monitoring functions of the described vending machine.

Although the attendant-operable input/output device constituted by the handset 19 is in the described vending machine, in the form of a plug-in unit 19, this input/output device could alternatively be constituted by a keyboard and display built into the machine. In this case, the input/output device could be arranged to be enabled whenever the machine was at "standby" during its vend mode of operation. The actual operation of such an integral input/output device could be substantially the same as the described handset 19.

Regardless of whether the input/output device is of integral form or is a separate handset, the alteration of data such as vend prices, throw times, stock constants and machine identity number can be arranged to be implemented only if a security code (for example, a six digit code) is keyed in prior to the keying in of each alteration required; such an arrangement ensures that these data are not altered inadvertently or by persons not having due authority. The keying in of bulk stock data would not be made subject to the prior keying of the security code. Alteration of the security code itself could be arranged to be possible only upon insertion of a physical link (in the same manner as described with reference to AUDIT FUNCTIONS above) followed by depression of a "Security Code" key of the keyboard 119, keying in of the new number and depression of the "memory store" key.

Further modifications to the attendant input/output device (whether in integral or handset form) are, of course, possible. Thus, the device can be simplified by omitting the facility to display audit data on selected drink types, the only audit data then displayable being total number of vends, total sales value, total number of test vends, and total sales value of test vends. Furthermore, the refinement of being able to key in, upon ingredient restocking, simply the number of bulk stock units (e.g. bags) added can be dispensed with, the attendant being required to update directly the maximum number of ingredient doses dispensable following restocking. In this latter case, the "display stock constant" and "bulk stock" keys shown in Figure 8 would be replaced by a single "doses dispensable" key; by pressing the appropriate ingredient key followed by the "doses dispensable key" the number of dispensable doses of the ingredient concerned is displayed and this number can then be updated using the digit keys followed by depression of the "memory store" key. This facility to amend directly the stored doses-dispensable number associated with each ingredient can be used, not only upon restocking, but whenever an alteration of this is required (in order, for example, to compensat for the cumulativ effect of under-estimation of the number of doses added during successive restockings.

Another possible facility with which the attendant input/output device could be provided is a "VAT rat " key enabling the current rate of value added tax to be set into the c ntrol system (by depressl n f the "VAT rate" key, th appropriate digit keys, and the "memory store" key). Given this information, the microprocessor 13 can be programmed to compute the VAT content of the total sales value, this VAT content

being optionally displayable by the provision of a "VAT display" key.

Furthermore, to assist the attendant the input/output device can be arranged to execut the same drink selection function as the external keyboard 20; indeed, this facility can be provided without the need to us a special key to indicate this function as th digit keys on the keyboard 119 would only be th first keys to be pressed when implementing the drink selection function, all other functions requiring the initial depression of a non-digit key.

With reference to the customer selection/display unit 21, this can be provided with an electronic price display controlled by the microprocessor 13 to display the various drink prices to a customer, this data already being held in the memory unit 18. This arrangement avoids the need to provide a price label that requires to be changed each time the price of any drink is altered. With the electronic price display, the displayed prices are automatically updated upon new price data being set in via the attendant input/display device. In addition, the use of an electronic price display enables the free vend light FV and associated latch 114 to be omitted since the free vend facility, when available, can now be indicated by programming the microprocessor 13 to set the displayed drink prices to zero upon the input 110 (see Figure 7) going low.

It will be recalled that the free vend facility can be made available under the control both of a time clock 112 and of a card reader 113. Such devices could also be used to implement a "discounted prices" facility where drinks are dispensed at reduced prices. As with the free vend facility, the microprocessor 13 is arranged to detect the bringing low of an input to the interface adaptor 16 either by the time clock or by the card reader to vend drinks at reduced prices, the latter preferably being displayed on an electronic price display.

In addition to controlling free vend and discounted vend periods (for example, up to nine periods per twenty four hours), a time clock can be used in the machine control system to effect various control functions. Thus, the time clock can be used to control general machine lights and the machine water boiler over a twenty four hour cycle such as to effect energy conservation; the clock can also be used to control an automatic flush cycle for self sanitisation of the machine. Furthermore, the clock can be used to give a time display on the machine front and to provide the time (and, preferably, date) on any print out provided by the printer 33.

The time clock can be implemented in hardware with outputs connected directly to the interface adaptor to provide time data to the processor; alternatively, the clock could be software implemented. In either case, the required preset trip times are preferably set in via the attendant input/display device, the latter being provided with appropriate control keys for this purpose.

A further possible variation to the described vending machine control system would be to replace the anti-jackpot circuit 30 by an auto-recovery circuit. In this variant, the auto-recovery circuit is arranged to monitor the program status in hardware and to take corrective action by causing a hardware reset in the event that a program "crash" is detected. The auto-recovery circuit is intended to keep the machine running in the event of an environmentally-induced program crash (for example, caused by extreme electrical noise such as may be produced by heavy plant switching or lightning strikes).

In one embodiment, the auto-recovery circuit is constituted by a hardware timer which after timing a predetermined period is arranged to generate a hardware reset for the microprocessor; however, the timer will under normal operating conditions of the control system, be itself reset before completing the timing of said period, this timer reset being generated in the microprocessor software. Should the program "crash", the timer will generally not be reset so that in due course it resets the whole system. The part of the program effecting resetting of the timer can also be used to check the various port definition registers provided in the interface chips constituting the interface adaptor 16; should the contents of any one of these registers be incorrect then the timer reset would not be issued so that the register would in due course be corrected as part of the initialisation process of the whole system following resetting.

It will be appreciated that the illustrated microprocessor control system in fact performs two functions, namely the function of controlling the machine actuators in dependence on various data inputs derived from devices such as the coin mechanism, the customer selection/display unit 21, and handset 19, and the function of data acquisition in respect of the number and type of drinks sold and the total receipts (the so-called audit data). While it would be a difficult task to modify or adapt existing vending machines employing electro-mechanical control systems to be controlled by an electronic (particularly a microprocessor-based) control system, at least some of the data acquisition features of the afore-described electronic control system can be imparted to an electro-mechanically controlled machine without undue interface problems.

An electronic data-acquisition unit for use with a vending machine having an electro-mechanical control system can in fact take a form very similar to the control system part of the Figure 1 arrangement, the main components being a microprocessor 13, clock 14, program and operational memory 15, interface adaptor 16, memory unit 18, plug-in printer 33, attendant input/output device (integral or handset form) and data-retrieval unit 200. In addition, the microprocessor 13 would also be arranged to receive inputs, via the interface adaptor 16, from various sensors indicative of each accepted drink selection and corresponding money received.

The operation of such a data-acquisition unit would be very similar to the operation of the Figure 1 control system in performing its data-acquisition tasks. Thus upon a drink selection being made and accepted by the electro-mechanical control system, the identity of the selected drink and the amount of cash received are input to the data-acquisition unit which as a result updates the audit data held thereby in th memory unit 18.

To enable a comprehensive audit data output to be made, details such as the price of each drink type can be set into the data acquisition unit through the attendant input/output device 19; similarly, the machin identity number can also be fed into the unit.

As with the Figure 1 system, audit data output can be effected in one of three ways, namely via the printer 33, via an optical display of the attendant input/output device 19, or via the data-retrieval unit 200.

The form of the sensors used for deriving input data from the electro-mechanical control system will depend on the exact nature of that system and appropriate sensor for each application will be apparent to persons skilled in the art.

Of course the data-acquisition unit need not necessarily be built around a microprocessor, other electronic means being also capable of providing the necessary data handling and storage tasks.

A data-acquisition unit can be fitted to a vending machine with an electro-mechanical control system either at the time of the machines manufacture or subsequently.

CLAIMS

1. A drinks vending machine including a plurality of machine actuators selectively operable to prepare any one of a number of different drinks from different types of ingredients stocked in the machine, and an electronic control system for controlling said actuators in dependence on the identity of a drink selected through a customer input device of the control system, said control system including both an electrically alterable memory for storing data on the required operating times of the machine actuators for each of said different drinks, and an attendant input device for altering the value of the operating times stored in said memory, the memory being arranged to retain the data stored therein upon switch off of the main electrical supply to the machine.

2. A drinks vending machine according to Claim 1, wherein the control system is built around a microprocessor.

3. A drinks vending machine according to Claim 1 or Claim 2, wherein the electrically-alterable memory is a non-volatile Electrically-Alterable Read Only Memory (EAROM) or a battery-backed Random Access Memory (RAM).

4. A drinks vending machine according to Claim 1, wherein the control system is so arranged that for each type of ingredient stocked, an attendant can set into the control system, via said attendant input device, data relating to the maximum number of doses to be allowed to be dispensed from the current stock thereof, the control system being further arranged to monitor the number of dispensed doses of each type of ingredient and to inhibit the preparation of a selected drink should that drink require the use of an ingredient of a type which has already been dispensed a number of times corresponding to the said maximum number associated with that ingredient type, data concerning the remaining allowable number of doses of each type of ingredient being held in said electrically alterable memory.

5. A drinks vending machine according to Claim 4, wherein the control system is so arranged that upon restocking of a particular ingredient type, the attendant need only set in the nominal number of doses in the newly added stock of that ingredient type, the control system being arranged to calculate for itself the new value of the corresponding said maximum number of doses by adding the set-in number with the remaining number of doses to be dispensed from the stock of that ingredient type present in the machine prior to restocking.

6. A drinks vending machine according to any one of the preceding claims, wherein data relating to the prices of the drinks selectable by a customer can be input into the machine, via the attendant input device, for storage in said electrically alterable memory.

7. A drinks vending machine according to Claim 6, wherein the control system includes an electronic display for displaying the drinks price data.

8. A drinks vending machine according to Claim 7, wherein the control system is arranged to dispense free or discounted drinks during predetermined time periods, the appropriate price data being displayed on said electronic display during these periods.

9. A drinks vending machine according to Claim 2, including a resettable hardware timer which, unless reset again within a predetermined period after having last been reset, is arranged to cause resetting of the microprocessor of the control system, the microprocessor during proper running of its program being arranged to reset the timer at intervals less than said predetermined period.

10. A vending machine including dispensing means arranged to dispense any one of a number of selections each made up of one or more types of components stocked in the machine, and a control system for controlling the said dispensing means in dependence on the identity of a said selection chosen through a customer input device of the control system, said control system including a stock-data input device by means of which an attendant can set into the control system, for each type of component stocked, data relating to the maximum number of times a component of that type is to be allowed to be dispensed from the current stock thereof, the control system being arranged to monitor the number of times each type of component is dispensed and to inhibit the preparation f a said selection should that selection require th use of a component of a type which has already been dispensed a number of times corresponding to th said maximum number associated with that component type.

11. A drinks vending machine substantially as hereinbef re described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1984.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.